Solving Simple Equations with One Unknown

In this section we will learn how to solve for an unknown value in a simple equation.

We will use the **Properties of Equations** to isolate the unknown value (**x**).

Let's look at the 4 possible types of equations that we will have to solve for an unknown value (**x**).

1. $x + 3 = 9$
2. $x - 4 = 12$
3. $2x = 10$
4. $\frac{x}{5} = 15$

In each of the 4 above examples, we need to **isolate the x** on the left side of the equation.

Let's look at the first one. $x + 3 = 9$

In order to isolate the x on the left-hand side of the equation we need to get rid of the **+ 3**.

The opposite of adding 3 is subtracting 3.

From the **properties of equations**, if we subtract 3 from the left-hand side of the equation, we must also subtract 3 from the right-hand side of the equation.

$x + 3 \mathbf{- 3} = 9 \mathbf{- 3}$

$x + 0 = 6$

$\mathbf{x = 6}$

We also know that you could have solved for **x** without doing all the steps that we listed above.

We suggest that you use this process because the equations in the following sections will become more complex.

The skills that you are learning here will serve you well in the future.

Let's use this process to solve the other three equations.

$x - 4 = 12$

The opposite of subtracting 4 is to add 4.

$x - 4 \mathbf{+ 4} = 12 \mathbf{+ 4}$

$x - 0 = 16$

$\mathbf{x = 16}$

We know that this is correct because **16** – 4 = 12.

For the next equation, **2x = 10**, we need to rewrite the left side as a multiplication.

$(2)(x) = 10$

The opposite of multiplication is division.

$$\frac{(2)(x)}{2} = \frac{10}{2}$$

$$\frac{\cancel{(2)}(x)}{\cancel{2}} = 5$$

$$(1)(x) = 5 \quad \text{because } \frac{2}{2} = 1$$

$$x = 5$$

We know that this is correct because (2)(**5**) = 10.

Finally, for the last equation $\frac{x}{5} = 15$, the **x** is being divided by **5**.

$$\left(\frac{x}{5}\right)(5) = (15)(5)$$

$$\left(\frac{x}{5}\right)\left(\frac{5}{1}\right) = 75 \quad \text{because } 5 = \frac{5}{1}$$

$$\frac{(x)(5)}{(5)(1)} = 75$$

$$\frac{(\cancel{5})(x)}{(\cancel{5})(1)} = 75$$

$$(1)(x) = 75 \quad \text{because } \frac{5}{5} = 1$$

$$x = 75$$

Here, we will multiply both sides by 5.

We know that this is correct because $\frac{75}{5} = 15$

We are ready to do more challenging examples.

Example

1. Solve the following equation.

x + 5 = 12

Step 1: Isolate the **x** by subtracting **5** from both sides of the equation.

x + 5 **- 5** = 12 **- 5**

x + 0 = 7

x = 7

So, **x = 7** because **7** + 5 = 12.

2. Solve the following equation.

x - 2 = 4

Step 1: Isolate the **x** by adding **2** to both sides of the equation.

x - 2 **+ 2** = 4 **+ 2**

x - 0 = 6

x = 6

So, **x = 6** because **6** - 2 = 4

3. Solve the following equation.

$3x = 24$

Step 1: Rewrite the equation.

$(3)(x) = 24$

Step 2: Isolate the **x** by dividing both sides of the equation by **3**.

$$\frac{(3)(x)}{3} = \frac{24}{3}$$

$$(1)(x) = 8$$

$$x = 8$$

So, **x = 8** because (3) (**8**) = 24

4. Solve the following equation.

$$\frac{x}{4} = 5$$

Step 1: Isolate the **x** by multiplying both sides of the equation by **4**.

$$\left(\frac{x}{4}\right)(4) = (5)(4)$$

$$\left(\frac{x}{4}\right)\left(\frac{4}{1}\right) = 20$$

$$\frac{(\cancel{4})(x)}{(\cancel{4})(1)} = 20$$

$$\frac{(1)(x)}{1} = 20$$

$$x = 20$$

So, x = 20 because $\frac{20}{4} = 5$

5. Solve the following equation.

$$2x = \frac{3}{4}$$

Step 1: Isolate the **x** by dividing both sides of the equation by **2**.

$$(2)(x) \div 2 = \frac{3}{4} \div 2$$

$$\frac{(2)(x)}{2} = \frac{3}{4} \div \frac{2}{1}$$

$$\frac{(\cancel{2})(x)}{\cancel{2}} = \left(\frac{3}{4}\right)\left(\frac{1}{2}\right)$$

$$(1)(x) = \frac{(3)(1)}{(4)(2)}$$

$$x = \frac{3}{8}$$

So, $x = \frac{3}{8}$ because $(2)\left(\frac{3}{8}\right) = \frac{3}{4}$